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IGC ANTARCTIC GLACIOLOGICAL DATA
FIELD WORK 1959-60

Some Operational and Mechanical Aspects of the 1959-60 Victoria Land Traverse

Report 968-3
Grant No. NSF-G8992

Arnold J. Heine
Institute of Polar Studies

January 1961

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SOME OPERATIONAL AND MECHANICAL ASPECTS OF THE 1959-60 VICTORIA LAND TRAVERSE

by

Arnold J. Heine
Institute of Polar Studies

The Ohio State University
Research Foundation
Columbus 12, Ohio

Project 968, Report No. 3

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ILLUSTRATIONS

TRAVERSE PERSONNEL

F. G. van der Hoeven	leader, seismologist, and radio operator
J. G. Weihaupt	assistant seismologist
A. W. Stuart	glaciologist
A. J. Heine (New Zealand)	assistant glaciologist
L. J. Roberts	navigator and surveyor
A. Taylor	geologist
C. Lorius (France)	glaciologist and solar radiation physicist
W. M. Smith	psychologist
T. Baldwin (U.S. Navy)	mechanic
W. Jackman (U.S. Navy)	photographer

Stuart, van der Hoeven, Weihaupt, Heine, Smith, Baldwin, and Jackman left Scott Base on October 16, 1959.

Taylor and Lorius joined the traverse on the Ross Ice Shelf on the 4th day.

Roberts arrived on the 19th day at the foot of the Skelton Glacier.

Jackman left the traverse at the Skelton Plateau depot on the 25th day.

Taylor was evacuated from Station 509 on the 40th day, 226 miles out from the Skelton Plateau depot.

The Traverse lasted 118 days.

Stuart, van der Hoeven and Heine wintered at Scott Base while Jackman and Baldwin wintered at NAF McMurdo. The remainder of the personnel flew from New Zealand to join the traverse. J. Russell, the mechanic originally appointed to the traverse, became ill during the winter at NAF NcMurdo and was unable to take part in the operations. A great deal of the vehicle overhaul work was done by a U.S. Navy mechanic, R. Clem, and he took part in the September journey but because of back injuries he was unable to leave with the traverse. T. Baldwin, also a U.S. Navy mechanic, then joined the party, but only on a temporary basis until Clem would take his place. It later became necessary to evacuate Clem to New Zealand and Baldwin remained with the entire traverse. Without his ingenuity and enthusiasm the 1520 mile jounrey would not have been possible.

The author of this report is indebted to the New Zealand Geological Survey and the New Zealand Antarctic Division for making it possible for him to take part in this traverse.

SUMMARY OF TIME AND MILEAGE

Traverse Schedule

The 1959-60 traverse route followed that of the 1958-59 traverse from Scott Base, across the Ross Ice Shelf to the Skelton Glacier, up the glacier to the Skelton Plateau depot, and then across the plateau to the 1958-59 traverse Station Number 84. From this point the 1959-60 traverse followed a new route. Night stops were given station numbers; the 1958-59 Station 84 becoming the 1959-60 Station 500. This was followed by Stations 510, 502, etc. Mileages are given in statute miles and were measured by a sled wheel attached to the rear of one of the sleds.

For 909 miles from the Skelton Plateau depot, the surface was generally very rough, but the remaining 260 miles of the traverse were over a comparatively good surface. The speed of the vehicles on the rougher surface averaged from two to four miles an hour. The altitude of the polar plateau varied between 7,500 and 8,500 feet above sea level.

October 16, 1959:	Left Scott Base.
October 27:	Arrived Lower Skelton depot.
November 8:	Arrived Skelton Plateau depot.
November 10:	Left Skelton Plateau depot.
November 12:	Arrived at Station Number 500.
December 2:	Arrived 1st airdrop, Station 515.
December 21:	Arrived 2nd airdrop, Station 529.
December 23:	Arrived at the French traverse terminus (Station 531--French designation B61)
December 28:	Left Station 529, retraced route for 42 miles before changing to new course.
December 30:	Left the turnoff point, Station 532.

January 15, 1960:	Left Station 544. Abandoned Detector there.
January 30:	Saw first mountain from Station 555.
January 30:	Arrived Station 556 and made final Plateau work station.
February 2:	Reached Station 558 and visited Welcome Mountain from here.
February 5:	Left Station 558 to descend to the Rennick Glacier to Station 559, a distance of 42 miles.
February 10:	Party evacuated from Station 559 and vehicles left there.

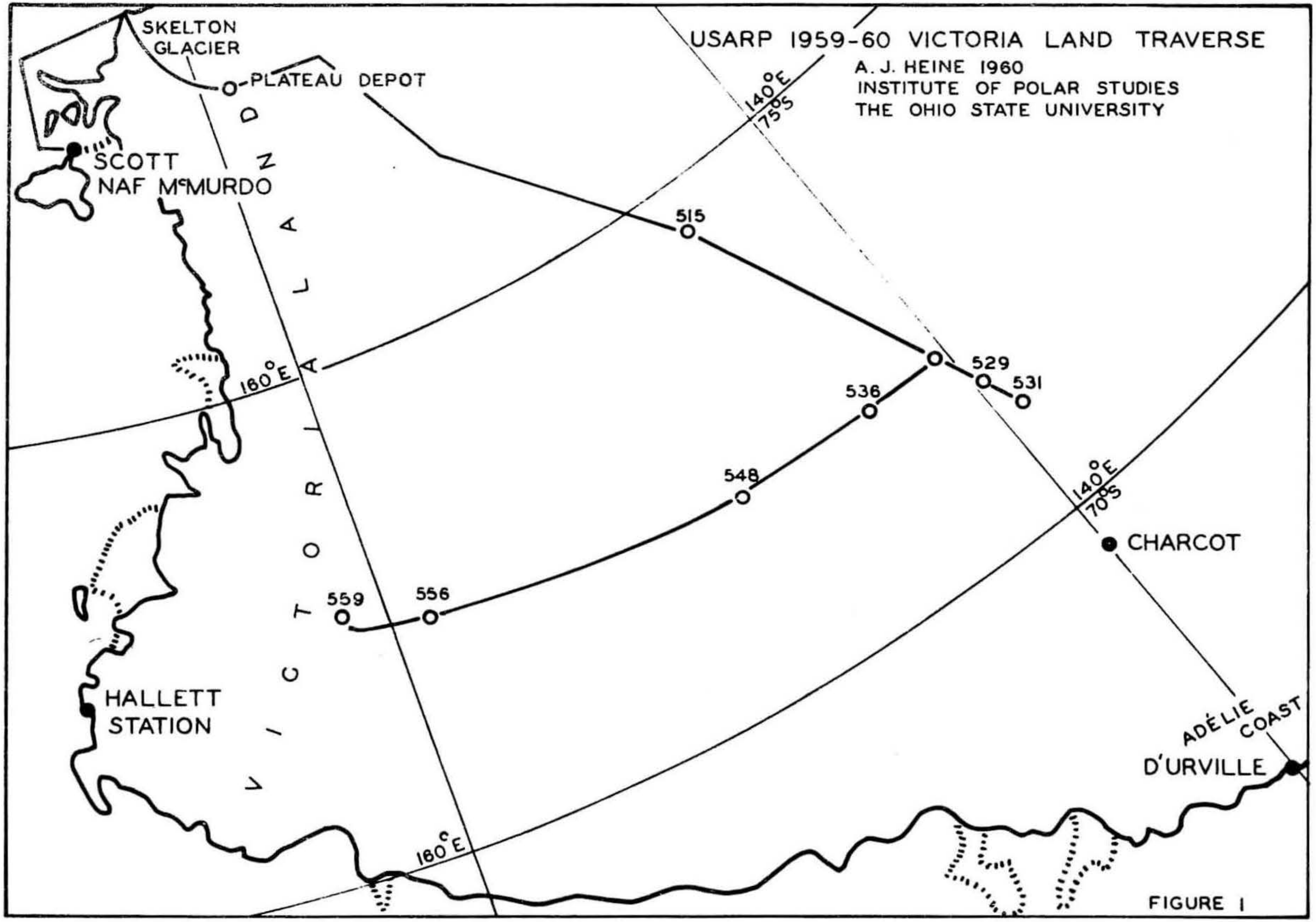
USARP 1959-60 VICTORIA LAND TRAVERSE
A. J. HEINE 1960
INSTITUTE OF POLAR STUDIES
THE OHIO STATE UNIVERSITY
SKELTON GLACIER
PLATEAU DEPOT
SCOTT
NAF McMURDO
VICTORIA LAND
515
529
531
536
548
556
559
140°E 75°S
140°E 70°S
160°E
160°E
CHARCOT
HALLETT STATION
ADÉLIE COAST
D'URVILLE

FIGURE 1

Daily and Cumulative Mileage

Scott Base to Skelton Plateau depot: 352 miles
Skelton Plateau depot to Station 500: 65 miles

Station No.	Distance from previous station	Distance from Scott Base
501	24.9 miles	442 miles
502	17.5	459
503	23.3	483
504	8.5	491
505	20.0	511
506	24.0	535
507	13.3	549
508	18.2	567
509	11.5	578
510	25.0	603
511	25.0	628
512	23.6	652
513	18.3	670
514	26.3	696
515	10.6	707
516	9.5	717
517	25.5	742
518	12.4	754
519	17.2	772
520	19.9	792
521	23.7	815
522	26.7	842
523	11.3	853
524	13.3	867
525	16.8	883
526	24.2	908
527	10.5	918
528	10.4	928
529	17.7	946
531	30.0	976
529	30.0	1006
532	42.0	1048
533	12.5	1061
534	13.7	1074
535	17.8	1092

Daily and Cumulative Mileage (cont)

Station No.	Distance from previous station	Distance from Scott Base
536	16.3	1108 miles
537	14.3	1123
538	11.7	1134
539	20.6	1155
540	11.9	1167
541	4.7	1172
542	22.6	1194
543	11.4	1206
544	12.9	1219
545	8.3	1227
546	10.8	1238
547	23.8	1261
548	24.8	1286
549	27.0	1313
550	28.6	1342
551	14.9	1357
552	7.9	1365
553	31.2	1396
554	23.5	1419
555	17.0	1436
556	13.4	1450
557	22.6	1472
558	6.3	1479
559	42.7	1521

Northwest leg of traverse: 559 miles
Back track along previous heading: 72 miles
Easterly leg of traverse: 473 miles

Mileage Between Work Stations

Work Station Number	Distance from Last Work Station
502	
504	32 miles
507	57
510	55
512	49
516	65
519	55
521	44
524	51
527	52
531 (B61)	58
536	132
540	59
544	52
548	68
550	56
553	54
556 (last Plateau work station)	54
559 (Rennick Glacier)	72

AIR SUPPORT

Air support during the Traverse was provided by the VX-6 squadron of the U.S. Naval Support Force, Antarctica. The two airdrops of fuel were made by Globemasters (C-124) of the U.S.A.F., using special four-drum pallets and ribbon parachutes.

October 15, 1959:	First flight with fuel, food, and explosives to the Skelton Plateau depot by R4D plane. Three later flights to the depot were completed by October 18.
October 19:	Taylor and Lorius were flown out by R4D plane to join the Traverse.
October 24:	Mail sent out by Otter (UC1) and the Rolli-tanker by helicopter (HUS-1A).
October 26:	Two helicopters (HUS-1A) attempted a Skelton Glacier recon-abortive.
October 27:	Three drums of fuel flown out by Otter (UC1) to the Lower Skelton depot.
November 3:	Two helicopters (HUS-1A) flew out with spares and Roberts. Recon of Skelton Glacier unsuccessful.
November 5:	Two helicopters (HUS-1A) flew out with mail and made successful recon of crevassed area on the Skelton Glacier.
November 9:	Two planes (R4D) flew out to the Skelton Plateau depot with bulk fuel, mail, and VIP's.
November 16:	Free drop of spare parts and mail by R4D plane.
November 25:	Helicopter (HUS-1A) flew out to evacuate Taylor. One plane (P2V) flew cover.
December 5:	Free drop of spares and mail by R4D plane.
December 23:	Christmas drop by parachute--spare parts and mail--made by one plane (P2V).
February 2, 1960:	Recon of Rennick and Tucker areas. Parachute airdrop of spares and mail by one plane (R4D).
February 9:	Unsuccessful attempt to evacuate the party with one plane (R4D)--cloud prevented a landing.
February 10:	Successful evacuation of party by R4D plane with 15 Jato.

LOADS PULLED BY THE SNOCATS*

Summary

	Weights ± 200 lbs		
	Messcat	Seismo	Detector
Leaving Plateau depot	5.5 tons	9.75 tons	4.25 tons
Arriving 1st Airdrop (Sta. 515)	4.0	5.25	3.5
Leaving 1st Airdrop	4.0	9.25	5.25
Arriving 2nd Airdrop (Sta. 529)	4.75	6.25	4.0
Leaving 2nd Airdrop	5.0	8.5	4.0
Leaving Station 536	8.0	2.75	5.25
Arriving Station 544	7.5	2.0	4.75
Leaving Station 544	8.0	3.5	abandoned

*The three Snocats on the traverse were named "Messcat", "Seismo", "Detector" for their principal functions.

Vehicle Loads

Leaving Plateau Depot

Messcat		Lbs.	
8 drums gasoline		3040	
4 drums oil and white gas		1650	
spares, Herman Nelson, etc.		1400	
		6090	sled load: 3 tons
plus weight of sled		2200	
plus small sled	load	2500	
	sled	400	
		2900	

Total pull on vehicle--5-1/2 tons.

Seismo			
9 drums gasoline		3420	
dynamite		4100	
equipment, etc.		1000	
		8520	sled load: 4-1/4 tons
plus weight of sled		2200	
plus Rollitanker	load	6150	
	vehicle	2510	
		8660	

Total pull on vehicle--9-3/4 tons.

Detector		
12 drums gasoline	4560	
drill rig	1000	
equipment, etc.	1000	
	6560	sled load: 3-1/4 tons
plus weight of sled	2200	

Total pull on vehicle--4-1/4 tons.

Arriving 1st Airdrop. Station 515. 365 miles from Plateau Depot.

Messcat		Lbs.	
1 drum gasoline		380	
oil and white gas		1500	
Herman Nelson heater		400	
spares, etc.		1000	
		3280	sled load: 1-1/2 tons
plus weight of sled		2200	
plus small sled	load	2200	
	sled	400	
		2600	

Total pull on vehicle--4 tons.

Seismo			
dynamite		3500	
equipment, etc.		1000	
		4500	sled load: 2-1/4 tons
plus weight of sled		2200	
plus Rollitanker	load	1230	
(200 gal.)	vehicle	2510	
		3740	

Total pull on vehicle--5-1/4 tons.

Detector		
7 drums gasoline	2660	
drill rig	1000	
equipment, etc.	1000	
	4660	sled load: 2-1/4 tons
plus weight of sled	2200	

Total pull on vehicle--3-1/2 tons.

Leaving 1st Airdrop. Station 515

Messcat

		Lbs.	
8 drums gasoline		3050	
oil and white gas		1500	
spares, Herman Nelson, etc.		1400	
		5940	sled load: 3 tons
plus weight of sled		2200	

Total pull on vehicle--4 tons.

Seismo

9 drums gasoline		3420	
dynamite		3020	
equipment, etc.		1000	
		7440	sled load: 3-3/4 tons
plus weight of sled		2200	
plus Rollitanker	load	6150	
(full)	vehicle	2510	
		8660	

Total pull on vehicle--9-1/4 tons.

Detector

13 drums gasoline		4940	
equipment, etc.		1000	
		5940	sled load: 3 tons
plus weight of sled		2200	
plus small sled	load	2200	
	sled	400	
		2600	

Total pull on vehicle--5-1/4 tons.

Arriving 2nd Airdrop. Station 529. 239 miles from 1st Airdrop.

Messcat		Lbs.	
7 drums gasoline		2660	
oil and white gas		1200	
spares, Herman Nelson, etc.		1400	
		5260	sled load: 2-1/2 tons
plus weight of sled		2200	
plus small sled	load	1700	
	sled	400	
		2100	

Total pull on vehicle--4-3/4 tons.

Seismo			
4 drums gasoline		1520	
dynamite		3020	
equipment, etc.		1000	
		5540	sled load: 2-3/4 tons
plus weight of sled		2200	
plus Rollitanker	load	2460	
(400 gal.)	vehicle	2510	
		4970	

Total pull on vehicle--6-1/4 tons.

Detector		
13 drums gasoline	4940	
equipment, etc.	1000	
	5940	sled load: 3 tons
plus weight of sled	2200	

Total pull on vehicle --4 tons.

Note: Over the distance between the two airdrops, Detector hauled the small sled 146 miles and Messcat hauled it the remaining 93 miles.

Leaving 2nd Airdrop. Station 529.

Messcat		Lbs.	
8 drums gasoline		3040	
oil and white gas		1200	
spares, Herman Nelson		1400	
		5640	sled load: 2-3/4 tons
plus weight of sled		2200	
plus small sled	load	1700	
	sled	400	
		2100	

Total pull on vehicle--5 tons.

Seismo			
9 drums gasoline		3420	
dynamite		2440	
equipment, etc.		800	
		6360	sled load: 3-1/2 tons
plus weight of sled		2200	
plus Rollitanker	load	6150	
(full)	vehicle	2510	
		8660	

Total pull on vehicle--8-1/2 tons.

Detector			
13 drums gasoline		4940	
equipment, etc.		1000	
		5940	sled load: 3 tons
plus weight of sled		2200	

Total pull on vehicle--4 tons.

Leaving Station 536. 102 miles from 2nd Airdrop.

Messcat		Lbs.	
7 drums gasoline		2660	
oil and white gas		1000	
spares, Herman Nelson		1400	
		5060	sled load: 2-1/2 tons
plus weight of sled		2200	
plus Rollitanker	load	6150	
(full)	vehicle	2510	
		8660	

Total pull on vehicle--8 tons.

Seismo		
3 drums gasoline	1140	
dynamite	1200	
equipment	800	
	3140	sled load: 1-1/2 tons

Total pull on vehicle--2-3/4 tons.

Detector			
12 drums gasoline		4560	
dynamite		1200	
equipment		1000	
		6760	sled load: 3-1/2 tons
plus weight of sled		2200	
plus small sled	load	1200	
	sled	400	
		1600	

Total pull on vehicle--5-1/4 tons.

Arriving Station 544. 110 miles from Station 536.

Messcat		Lbs.	
5 drums gasoline		1900	
oil and white gas		950	
spares, Herman Nelson		1400	
		4250	sled load: 2 tons
plus weight of sled		2200	
plus Rollitanker	load	6150	
(full)	vehicle	2510	
		8660	

Total pull on vehicle--7-1/2 tons.

Seismo		
dynamite	1200	
equipment	800	
	2000	sled load: 1 ton
plus weight of sled	2200	

Total pull on vehicle--2 tons.

Detector			
9 drums gasoline		3420	
dynamite		1200	
equipment		1000	
		5620	sled load: 2-3/4 tons.
plus weight of sled		2200	
plus small sled	load	1200	
	sled	400	
		1600	

Total pull on vehicle--4-3/4 tons.

Leaving Station 544

Messcat		Lbs.	
7 drums gasoline		2660	
oil and white gas		950	
spares, Herman Nelson		1600	
		5210	sled load: 2-1/2 tons
plus weight of sled		2200	
plus Rollitanker	load	6150	
(full)	vehicle	2510	
		8660	

Total pull on vehicle--8 tons.

Seismo			
2 drums gasoline		760	
dynamite		1200	
equipment		1200	
		3160	sled load: 1-1/2 tons
plus weight of sled		2200	
plus small sled	load	1200	
	sled	400	
		1600	

Total pull on vehicle--3-1/2 tons.

Note: Distance from Station 544 to end of the traverse was 302 miles.

FUEL

Supply

Fuel was flown into the Skelton Plateau depot, first in drums; on the party's arrival at the depot, the Rollitanker was filled directly from the plane's fuel tanks. R4D U.S. Navy planes were used for these operations.

Two fuel airdrops were made by the U.S. Air Force, using Globemaster C-124 planes. The first drop of 56 drums was made at 74°34.10'S, 144°23.90'E, and the second of 68 drums at 71°29.55'S, 139°53.58'E.

After the drops had been made the plane circled and then waited, flagged bamboos were dropped from the plane, half a mile apart, in such a way that there were about 10 flags on each side of the depot. The line of flags were about perpendicular to the general traverse route. They were numbered, but unfortunately were not dropped consecutively. However, the numbers gave some idea of the direction of the depot, as the first flag reached was several miles from the depot. In both cases the line of flags were within a mile of the airdrop. This was quite remarkable as after the drop had been made, the plane's crew were unable to see the pallets on the snow and so had to judge their position in relation to the drop before dropping out the line of flags. Several bamboo poles had splintered as they had hit the snow, but the majority were firmly fixed into the surface. The flags were made of "day-glo" material, about 8" by 24" and were discernible from a distance of several miles.

The four-drum pallets were dropped with ribbon cargo parachutes, and only one failed to open. The drums on this pallet were split, and the fuel lost. Several pallets landed upside down, and a great many were driven about three feet into the snow. Some pallets were easily pulled out by using a Snocat and a heavy wire rope around the base of the pallet. Fuel was also pumped directly from the buried drums into the Rollitanker and into the fuel tanks of the Snocats.

Gasoline Consumption

	Fuel Used
Scott Base to Skelton Plateau depot:	1500 gallons
Estimated mileage of 3 vehicles: 1200	
Fuel consumption: 1.3 gallons/mile	
Skelton Plateau depot to 1st airdrop:	1950 gallons
Estimated mileage of 3 vehicles: 1950	
Fuel consumption: 1.8 gallons/mile	
1st airdrop to 2nd airdrop:	950 gallons
Estimated mileage of 3 vehicles: 750	
Fuel consumption: 1.3 gallons/mile	
2nd airdrop to Station 531 and return:	260 gallons (estimated)
Estimated mileage of 3 vehicles: 200	
Fuel consumption: 1.3 gallons/mile	
2nd airdrop to Station 544	900 gallons
Estimated mileage of 3 vehicles: 650	
Fuel consumption: 1.4 gallons/mile	
Station 544 to Station 558	800 gallons
Estimated mileage of 2 vehicles: 550	
Fuel consumption: 1.5 gallons/mile	
Station 558 to Station 559	150 gallons (estimated)
Estimated mileage of 2 vehicles: 120	
Fuel consumption: 1.3 gallons/mile	

Carburetor Jets

Carburetor jets of size .52 in. were used from Scott Base to the Skelton Plateau depot, a distance of 352 miles. These jets were kept in use until Station 519, 429 miles from the Skelton Plateau depot. At this station new jets of .46 in. size, and which had been airdropped to the party, were fitted to the carburetors. They were used on the remaining 739 miles of the traverse.

Icing In The Fuel Lines

A great deal of trouble was experienced when ice formed in the fuel lines of the vehicles. Alcohol was added to the fuel tanks from time to time and gave some relief; but as the supply was limited, the trouble soon reoccurred. A black sludge, probably from the liner of the Rollitanker, also caused blockages in the ceramic fuel filters. Not only did ice form in the fuel lines and black the ceramic filter, but ice also formed in the bottom of the fuel tank. The tank was then tapped until the ice broke up and fuel flowed freely again. On several occasions it was necessary to blow through the line and dislodge the pieces of ice lying in the bottom of the tank. It had been assumed that the outlet of the tank was actually an inch or so above the bottom of the tank, but this may not have been so.

Two remedies are suggested. The first is to make regular additions of alcohol to the tank, and the second is to redesign the fuel line and filter. I would suggest a fuel line of at least half-inch pipe. Care would be needed when arranging the fittings and the route of the pipe from the back to the front of the vehicle. There is a danger that if the pipe is of too large a diameter, it will not be flexible enough to withstand the twisting and wracking of the chassis. It may be possible to use a flexible pipe, but it should be remembered that temperatures down to minus 50° can be experienced on the Plateau, and ordinary flexible fuel line material would become brittle at that temperature.

The fuel should be filtered when the vehicle is filled from drums or from the Rollitanker. I would suggest a disposable paper filter, because when a gauze filter is used, it must be warmed to remove the ice particles trapped in the gauze. It may also be possible to devise a large fuel line filter in which disposable paper filters, similar to the replacable cartridge type oil filter, may be used. The filter should be placed in a easily accessible position and, preferably, sheltered from the wind. Gasoline-soaked gloves soon cause frostbite, especially in strong winds below zero. A branch pipe, together with stop-cock, should be placed in the fuel line near the fuel pump inside the vehicle. This would be used if it became necessary to blow through the fuel line.

SNOCATS

Chassis Breakdown Of "Detector" Snocat

Narrative

The following extracts are from the author's diary.

December 13, 1959

About five o'clock we were stuck on a small rise. Put a tow rope on the sled and then found that one of the brackets holding the top part of the rear fifth wheel had broken at the weld. Then discovered that a number of the chassis welds near the back fifth wheel had also broken. Took a lead off our (Detector's) big batteries and also a cable from Seismo, connected to their big batteries as well. Started off trying to use 1/8-inch wire but as it was galvanized this wasn't so good. Then tried 6-inch nails. Tom did most of the welding and Franz a little. Seemed to stick O.K. Went for a run in the Snocat and then found one of the new welds cracked already. Tom put on more welding and also a few runs along the chassis cracks. Had a look at the chassis of Seismo and Messcat and found the chassis cracks. Had a look at the chassis of Seismo and Messcat and found that both of them had been strengthened with heavy cross braces--probably done at Little America before the departure of the 1958-59 traverse (which used these two Snocats).

Comment: The discovery of breaks in the chassis was made at Station 523, which is 146 miles from the 1st Airdrop and 863 miles from Scott Base.

December 14, 1959

Found that the welded bracket had not held. Left small sled behind for Messcat.

December 15, 1959

Tom did more work on fixing the chassis trouble. The bracket which broke off was only welded along the top edge instead of the sides and bottom, as on the other Snocats. When we took the bracket off we found quite a hole under the weld. Looked more like a flaw in the chassis member than a weld burn hold. From this hole (it had jagged corners) had started two cracks across the chassis box section. Tom put a bolt from the fifth wheel straight through to a gusset plate welded onto the chassis.

Comment: The vehicles then proceeded to the 2nd Airdrop.

December 28, 1959

Found that the "Detector" chassis had cracked a little more and that the bracket and bolt weren't holding. (The traverse then left the 2nd Airdrop along the second leg of the route.) Tried welding the chassis that evening. Now had some No. 10 welding rods, a proper mask and a holder (from the Xmas airdrop) but still didn't work too well. The voltage seems too low.

January 5, 1960

Yesterday Seismo broke the drawbar hitch on the back of that vehicle so the sled loads were rearranged. We loaded dynamite onto our sled. Also took the small sled.

Comment: The next day, January 6, we left Station 536 with the extra load.

January 11, 1960

When we stopped at night had a look under our vehicle. Found that the bottom chassis member, opposite to the one which had cracked first, had broken right in half just in front of the brace holding the steering ram. This brace was still in place but cracked around the weld on the side where the chassis had broken in half. Also the chassis cracked on the other side (the side of the original crack). Tom and Franz tried some more welding but didn't have much luck. Tom put a "come along" onto the hydraulic cross-brace and up to the front of the chassis.

Comment: When the drawbar hitch broke off Seismo, its sled was hitched to the rear step of the vehicle. This itself was cracked where it had been welded to the chassis, and the Seismo crew was afraid that if the step broke off they would be unable to pull any load. This was probably a false supposition, as it would have still been possible to put a wire hitch around the chassis itself. There were actually two choices: (1) load up Detector's sled and hope that chassis would not break too much more, or (2) take the risk of the step breaking off Seismo, creating fresh problems. Becuase Seismo was considered to be the most valuable of the Snocats, whereas Detector was expendable, it was decided not to risk Seismo. By the end of this day, January 11, Detector had hauled the extra load 86 miles.

January 13, 1960

About two o'clock when I was driving, I heard a noise and found that the track on the right rear pontoon had come out of the bottom track guide. Decided to make a station. Found the Snocat chassis pretty well broken up. The frame behind the fifth (rear) wheel had broken right through. Two other brackets holding this fifth wheel to the chassis had broken off.

<u>Comment</u>: The vehicle was left at Station 544. We had travelled 24 miles since the last attempted repairs on January 11.

Summary of Breakdowns

<u>December 13</u>. First discovery of chassis failure after travelling 863 miles from Scott Base to Station 523.

<u>January 5</u>. Took on dynamite and small sled at Station 636; had travelled 255 miles since December 13 (60 miles of this distance without a sled).

<u>January 11</u>. Major disintegration of chassis discovered at Station 542; had travelled 86 miles since January 5.

<u>January 13</u>. Final breakdown at Station 544; had travelled 24 miles since January 11.

Summary of Loads Pulled by Detector

<u>Plateau depot to 1st Airdrop</u> - Started: 4.25 tons Finished: 3.5 tons

<u>1st Airdrop to 2nd Airdrop</u> - Started: 5.25 tons Finished: 4.0 tons

In this distance Detector hauled the small sled (1.5 tons) 146 miles and Messcat the remaining 93 miles.

<u>2nd Airdrop to Station 536</u> - Started: 4.0 tons Finished: 4.0 tons

<u>Station 536 to Station 544</u> - Started: 5.5 tons Finished: 4.75 tons

Analysis of Chassis Breakdowns

1. The chassis was not strengthened on this new Snocat, whereas the other two Snocats, which had been used on the 1958-59 Victoria Land Traverse, had been strengthened. These two older Snocats showed no signs of chassis failure at the end of the traverse.

2. On the discovery of failure in the chassis Detector, satisfactory repairs could have been made:

   a. if a portable electric welder had been carried by the traverse. It is doubtful whether repairs could have been made with an oxy-acetylene unit, although an attempt would have been made if one had been carried;

   b. if a portable electric welder could have been flown in from McMurdo. As the snow surface was too rough for ski landings, such a unit would have had to be parachuted in to the traverse.

3. The first inspection showed two things:

   a. a broken bracket holding the rear fifth wheel to the chassis, and,

   b. cracks in the welds of the cross members to the longitudinal chassis members in the vicinity of the rear fifth wheel.

It would be impossible to say which of these two failures occurred first. Failure of either one would contribute to the failure of the other. It is likely that insufficient welding around the bracket caused this to break off fairly easily. Later, two more of these similarly welded brackets broke off.

4. Although it was possible to make a temporary repair by bolting the fifth wheel to the chassis, this did not help the breaks in the welds of the chassis.

5. Once several of the chassis welds had cracked, it was only a matter of mileage before further chassis welds cracked; and, in time, the whole chassis assembly disintegrated.

6. The hauling of a heavy sled after the first discovery of chassis failure no doubt hastened the final collapse. It is worthwhile noting that the continuing use of Detector after the Skelton Plateau depot (where the crevasse detection gear was removed from the vehicle) was one of convenience rather than absolute necessity. That is, this Snocat did not contribute materially to the traverse other than to (a) provide travelling and sleeping quarters for three of the

traverse members, (b) haul the glaciological equipment and at times some food and explosives, and (c) provide a third vehicle as a spare in case the other two completely broke down. Unless Detector could haul at least its own fuel, the continued use of this Snocat would only shorten the range of the traverse.

7. The addition of the extra load of dynamite and the small sled to Detector after Station 536 probably hastened the final collapse of the vehicle.

Tie Rod End Failures

Narrative

The following tie rod ends were broken:

	Date	
Messcat	25/10/59	Rear end of rear tie rod.
	10/11/59	Front end of front tie rod.
	16/12/59	Rear end of rear tie rod.
	9/1/60	Front end of front tie rod.
Seismo	29/10/59	Rear end of rear tie rod (result of falling into a crevasse).
	22/12/59	Front end of front tie rod (hauling no sled).
Detector	23/11/59	Nut fell off front end of front tie rod.
	13/12/59	Front end of front tie rod.
	27/12/59	Front end of front tie rod (hauling no sled).
	28/12/59	Rear end of rear tie rod.
	12/1/60	Front end of front tie rod.

Analysis of Breakages

1. All tie rod end failures were of those tie rod ends attached to the fifth wheels.

2. Distribution of load types did not appear to influence the tie rod end breakages. Because Seismo only had two breakages, one in a crevasse and the other when not hauling a sled, the jerking motion of the Rollitanker apparently did not cause breakages. Messcat did not have any breakages after taking over the hauling of the Rollitanker.

3. Seismo hauled the heaviest loads at certain periods, but had few breakages.

4. The actual fracture of the tie rod end was examined on two occasions: (a) on 27/12/59, it appeared that a crack in Detector's tie rod end had started at the end of the thread on the taper section. The thread ended abruptly and left a sharp corner rather than a gradual runout of the thread form. From the coloration of the break, it seems possible that a crack had existed part way through the metal for some time before the final complete fracture. (b) On 28/12/59, the break in Detector had occurred part way up the taper.

5. Some crystallization in the fracture zone was noted.

Possible Causes of Fracture

1. Fatigue of the metal due to low temperature.

2. Fatigue of the metal due to a small movement within the taper of the fifth wheel. The tie rod end has on it a steel sleeve which in turn fits into the tapered hole in the aluminum casting of the fifth wheel. The exceptional wracking of the chassis of the Snocats would add additional stresses to the tie rod connection to the fifth wheel. It should be understood that one end of the tie rod is attached (with a knuckle joint) to the steering leverage on the chassis, while the other end of the tie rod (also with a knuckle joint) is fixed to the fifth wheel. When a Snocat is travelling over extremely rough sastrugi, the front left pontoon is on a different level than the front right pontoon, and the front fifth wheel will be tilted over at an angle to the chassis. In an extreme case, the travel in the ball joint of the tie rod end may not be sufficient to allow free movement and would impart a twisting action on the tie rod end itself.

3. Tie rod ends not securely fixed in the taper of the fifth wheel. Because no box wrench to fit the large nut of the tie rod end was carried on the traverse, it was necessary to use a hammer and chisel to tighten the nut. Replacement tie rod ends were sent out with a smaller nut on them, but because no large washers were with them, the same large nut had to be used on replacement tie rod ends. The taper of the tie rod end has a steel sleeve on it which fits the

tapered hole in the fifth wheel--this is a fairly large hole, and hence it is necessary to use either a large nut or a large washer and small nut. Continual use of a chisel caused some damage to the nut.

4. A number of the replacement tie rod ends were not new, and it is possible that fatigue crystallization had begun before the replacements were used on the Snocats. Tie rod ends were extremely scarce at McMurdo, and spares for our traverse were taken off existing vehicles there.

5. After the surface improved, about January 20, no more tie rods were broken.

Broken Springs

At the following times, springs were replaced on the vehicles:

Detector	Seismo	Messcat
13/12/59	25/10/59	26/10/59
	6/12/59	10/11/59
	4/1/60	29/12/59
	9/1/60	5/1/60
	16/1/60	16/1/60
	28/1/60	

In several cases only one or two leaves were broken in the springs, and then only these broken leaves were replaced.

With perhaps one exception, all spring replacements made were on the rear of the vehicles. As the two Snocats which suffered the the greatest spring damage also hauled the heaviest loads, at certain times, the spring breakage could have been caused by excessive drawbar pull. However, these two Snocats had taken part in the previous year's traverse, and it is not certain whether new springs were put on the vehicles before the departure of our traverse. If the old springs were left on the vehicles, it would only be a matter of mileage (together with the low temperatures) before crystallization began in the springs and failure took place. Excessive loading and the "tugging" effect of the Rollitanker would cause more flexing of the springs and consequently hasten crystallization.

By 20 January, the surface had improved and continued to improve as the traverse neared the mountainous area. Only one spring needed replacement after this date; but, of course, the sled loads were also decreasing at this stage of the traverse.

Additional Mechanical Breakdowns

Track Links

On five occasions track links were broken on Messcat. As the other two vehicles did not experience this trouble, it is possible that the cause of the breakages was due to some maladjustment of the tracks before the start of the traverse. New tracks were put on Seismo and Messcat before leaving McMurdo.

Pontoon Bearings

Seismo and Messcat had pontoon bearing trouble. I am not certain whether the pontoons and bearings of these vehicles were replaced after the completion of the 1958-59 traverse. If they were not, it could be just a case of simple wear and breakdown.

Fifth Wheels

The first fifth wheel to break, on Detector, occurred when the vehicle fell into a crevasse. A crack was found in the casting around the horizontal pivotal pin. This was a front fifth wheel. In a second instance, a lug (to which one end of the spring is attached) snapped off the bottom section of the rear fifth wheel on Seismo. The vehicle was hauling a load of about eight tons and was travelling over an extremely rough surface. In a third instance, a similarly placed lug broke off the bottom part of the rear fifth wheel on Messcat.

Both Seismo and Messcat had taken part in the previous year's traverse, and it is possible that progressive crystallization in the aluminum casting of the fifth wheel caused the eventual fracture.

Universals

2/12/59 - Messcat broke a part of the universal on the front pontoon drive. It was the clamping device holding the needle rollers in position.

3/1/60 - Seismo broke a universal on the front pontoon drive.

16/1/60 - Seismo broke a universal on the main drive.

20/1/60 - Messcat replaced universals on the front pontoon drive.

20/1/60 - Seismo broke a universal on the front pontoon drive.

25/1/60 - Messcat broke a universal on the rear pontoon drive.

Both these snocats had been on last year's traverse and, therefore, had at least twice the mileage of Detector. Failure of the universals was probably due to wear of the needle rollers, resulting in binding to the bearing surface and then the disintegrating of the cages.

Differentials

19/12/59 - Rear differential replaced in Messcat.

16/1/60 - Rear differential replaced in Seismo.

In both cases it was found that the teeth on the crown wheel had become chipped and, consequently, made it necessary to replace the differential. Both vehicles had travelled long distances. It is possible that the low temperatures could assist in the breakdown of the heat-treated teeth of the crown wheel. I am not sure of the effect of low temperature on the grain structure of high carbon steels.

Drawbar Hitch - Seismo

The drawbar hitch on Seismo broke after travelling 1,118 miles on this traverse. One end of the drawbar had been welded to the chassis some distance from the rear of the vehicle, while a spacer was welded between the rear edge of the chassis and close to the other end of the drawbar. It appeared that the drawbar-chassis weld broke out of the chassis box section; then the spacer broke off, not right at the chassis weld, where I had expected, but a half-inch from this weld, where the steel of the spacer had crystallized. I am sure that the failure of the drawbar was due to fatigue of the metal components. I would suggest that the drawbar be bolted at one end to a plate welded to the full width of the chassis and that the spacer be bolted at one end to the drawbar and at the other, to a plate welded to the full width of the chassis. The "tugging" effect of the Rollitanker makes it all the more important to have a very strong, but replaceable, drawbar. If a vehicle is to be used on a second traverse, it would be advantageous to fit a new drawbar before the start of that traverse.

SLEDS

Description

The traverse party left Scott Base with three "2-1/2-ton" sleds (one per Snocat), as well as one "Maudheim"-type sled. The "2-1/2-ton" sleds were supplied by the U.S. Navy and are a four-ski articulated design. Their approximate weight is 2,200 pounds, and they are built to carry loads of two to four tons. The "Maudheim" sled had been used by the New Zealanders, during the construction of Scott Base, in several hundred miles of heavy cargo hauling. The sled is made of hickory in a light flexible construction with steel-soled solid runners, weighs about 400 pounds, and can carry a load of one to two tons. This sled had a simple wire rope towing hitch. On the traverse, the large sleds generally carried loads of two to three tons, whereas the small sled had loads of one-half to one and a quarter tons. These loads alone were not excessive, but when combined with the extremely rough surface, helped in the disintegration of the sleds. Although articulated sleds will generally ride more easily over a rough surface than will a solid-runnered sled, the small sled taken on the traverse finished still in good condition. The speed of the vehicles averaged two to four miles an hour.

Repairs to the sleds began after 860 miles had been travelled. Breakdowns continued thereafter. New spreader bars were airdropped on December 23. It was found that the new spreader bars could not be fitted to the front pair of skis. However, the new bars could be used for the rear skis, but after a while, they too broke. Finally the broken bars were successfully adapted for the rear skis. Other mishaps included wearing and breaking of the ski chains, breaking of the ski pivot pins, and wearing around the crosstie center pins.

Ski Spreader Bars

The front spacer bar attaches the drawbar to the two front skis and at the same time keeps them in a parallel course. The rear spacer bar attaches the crossed towing chains (the other ends of which are attached to the front lower crosstie) to the front of the two rear skis. The spacers are fabricated from heavy steel piping with solid pins welded into each end of the pipe. The end pins fractured in all cases. The spacer is not designed for two-level operation (Fig. 2), and consequently when rough surfaces were encountered, a great deal of flexing of the pin occurred; fractures usually took place just inside the outer face of the washer welded into the end of the pipe. Although spare spreader bars were sent out to the traverse party, at times it was necessary to make temporary repairs. The front spreader bar was discarded and the drawbar attached directly to the front of the skis, either by bolts or by wire rope. In this way, the drawbar pull came directly on the skis instead of through chains to the lower front crosstie. It would be difficult to say whether this change contributed to the breaking of the ski swivel pins. At the rear, the broken spreader bars were fixed by either wire rope or bolts to the front of the rear skis. The crossed chains joining the rear and front lower crossties were not reattached to the front of the rear skis. In this way, the rear skis were not held in position nor were guided on the turns by the chains, but simply followed along in the tracks of the front skis.

The spreader bars are held in position by split pins. Side pressure of the skis sheared off the split pins and, in several cases, the rear spreader bars then fell out. The front spreader bar is made up within the drawbar frame, and when the split pins are sheared off, the skis can then become detached from the drawbar assembly.

Recommendations

1. The front spreader bar could be discontinued, and instead, a heavy bolt and nut (as well as a split pin outside the nut) used to attach the drawbar assembly, the front towing chains, and the front skis together.

2. No simple solution to the rear spreader bar troubles can be suggested. Less strain on the bar would be effected by flaring both sides of the hole in the front of the rear skis. Then, by adding large washers to each side of the skis, as well as loosely assembling the units on the pins of the spreader bars (suggest a total clearance of 1/2 inch sideways in the assembly), there should be less chance of the spreader bars giving trouble. Spare spreader bars should be taken on a traverse.

Chain Wear

The chains joining the rear and the front bottom crossties are crossed. When the sled travels over a rough surface and the skis are on different levels, the chains rub together at the crossing point. On the traverse, one chain broke, and the front ski assembly was pulled from under the sled bed. A great deal of work was necessary to reassemble the sled. It was found that the chains on the other sleds were also worn and needed replacement. Spare links and chains were used in repairs.

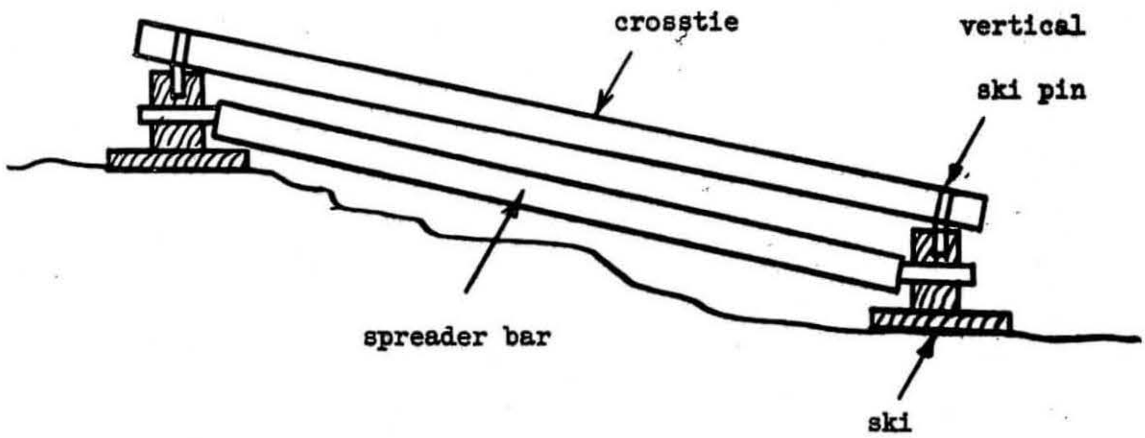

Fig. 2. Diagram showing bending of spreader bar and vertical ski pins when skis are on a two-level surface.

Recommendations

As the chain wear occurs only at the actual crossing point of the chains, replacement of the worn links would be quicker if the center 24 inches of each chain were attached by shackles to the rest of the chain. It would be a simple matter then to replace the short section of worn chain, and the actual worn links could be replaced at a later date.

Vertical Pins and Brackets Holding Skis to Crossties

The skis are fixed to the crosstie by two means:

1. A steel bracket goes over the crosstie and is bolted to the ski.

2. A steel pin is firmly fixed into the wooden assembly of the ski, passes through the crosstie, and is held at the top by the bracket.

The bracket and pin allow the ski to swivel with some degree of freedom about the end of the crosstie. This is sufficient for normal sled running, but when travelling over a very broken surface, the ski is pushed up and down in such a way that a great deal of strain comes on the pin. Strain is placed on the pin also, if there is a great difference between the levels of the left and right skis. Many of the pins on the traverse sleds were broken. The bracket then works loose and, in doing so, wears on the bolts holding the bracket in place. On one occasion, one of these bolts broke off, the bracket failed to hold the ski (the pin was already broken), and it was pulled from under the sled. All the pins broke at the junction of the top of the ski and the base of the crosstie. This would appear to be the zone of major strain. Crystallization of the steel at the fracture had also occurred.

Recommendations

I cannot suggest any simple alternative design. The pins and brackets should be frequently checked and spare pins and bracket holding-down bolts taken on the traverses.

Crosstie Pivot Pins

The crossties were held together by a heavy steel pin which was held in position by two washers and split pins. The washers wore into the wood of the crosstie; and, in one case, the two crossties pulled apart and the pin was bent.

Recommendations

Steel plates should be fixed at the top of the upper crosstie and the bottom of the lower crosstie in order to prevent wear into the wood. The steel plates fixed between the upper and lower crossties also came loose. The plates should be longer and should be fixed to the wood of the crosstie by heavier and longer screws. The sleds should not be backed, as this can cause the center pin to bend, especially if there is a gap between the upper and lower crosstie, or the ends of the center pin have worn into the wood.

Summary of Loads on the "2-1/2-Ton" Sleds

	Messcat	Seismo	Detector
Leaving Plateau depot	3 tons	4.25 tons	3.25 tons
Arriving 1st Airdrop	1.5	2.25	2.25
Leaving 1st Airdrop	3.0	3.75	3.0
Arriving 2nd Airdrop	2.5	2.75	3.0
Leaving 2nd Airdrop	2.75	3.25	3.0
Leaving Station 536	2.5	1.5	3.5
Arriving Station 544	2.0	1.0	2.75
Leaving Station 544	2.5	1.5	abandoned

The Use of Sleds on Oversnow Traverses

A number of U. S. oversnow traverses have used the small "1-ton" sled, a rigid runner type which is similar to the "Maudheim" type, but has the great advantage of side gates. These sleds have proved quite satisfactory, although they have several minor disadvantages. While crossing rough surfaces, the loads are bounced around and require either the use of gates or of careful lashing. The use of either articulated or solid runner sleds is governed largely by the snow surface to be expected on the traverse.

It is my opinion that greater use could be made of wheeled trailers on oversnow traverses, particularly on the hard surfaces on the polar plateau. The Rollitanker, despite "bugs," proved a successful means of transporting fuel, although the same quantity of fuel could have been carried on "1-ton" sleds at little extra weight. (Although the sleds weigh about the same as the Rollitanker, the latter requires less power to pull; hence, its big advantage.) On the hard snow conditions encountered on the traverse, I think several two-wheeled trailers would have been quite satisfactory. These should be well sprung. I would further suggest the investigation of a type of four-wheeled trailer having independently sprung, caster-type wheels and using low pressure (5-10 lbs./sq. in.) tires. This trailer would be useful for food and equipment haulage and, perhaps, for fuel drums. The other alternative is to build a cargo platform on the Rollitanker. It would then be necessary to keep a steady air pressure in the Rollitanker when the fuel is discharged. If air-dropped fuel depots were used, the Rollitanker would have the advantage of allowing fuel to be pumped directly from the usually half-buried drums into the transporter. Of course, if drums were used, the empty ones could be kept on the sleds, and they too could be refilled by pumping from the depot drums.

FOOD

General

The traverse food list was based mainly on the food available, using for a general basis a suggested ration scale by the U.S. Army Quartermaster Corp. Extra items were obtained from the U.S. Navy. The quantities were made up in six one-hundred and fifty man-day units. Four of these units were flown into the Skelton Plateau depot, and the other two with the frozen bread and meat were taken by sled to the depot. Additional food was obtained at the depot; this had been left by the 1958-59 Traverse. A quantity of emergency rations such as the Arctic pack (one-man day unit) and the "five in one" pack (five-man day unit) were also taken to be used in the event of the party being forced to man-haul out to Hallett Station. Extra food was sometimes sent in with the airdrops, while special mention should be made of the magnificent Christmas airdrop of fresh fruit, vegetables, and other "goodies" which was safely parachuted in to the party. We were indeed grateful to our Navy and U.S.A.R.P. friends back at McMurdo. A much greater quantity of hot chocolate drink was consumed than anticipated, despite some additional supplies from Scott Base, and it was necessary to airdrop more to us. One carton of frozen steaks decayed and could not be eaten, and consequently the meat supplies were rationed towards the end of the traverse. The frozen bread proved excellent, and again thanks are due to the Navy cook at McMurdo. The "secret" of keeping the frozen bread fresh, is to wrap it in airtight material before freezing so that the moisture is not lost during the freezing process. Once the bread is frozen, it does not matter if the bread is then unwrapped.

The original plan was to eat the frozen meats at the evening meal and the canned meats during the work station midday meals. To provide food while travelling, chocolate, canned nut rolls, sardines, boned chicken, etc., were taken. As it happened, the desire for the first two items proved negligible. I suspect that the continual rough travelling, possibly giving a mild form of motion sickness, combined with the general inactivity and boredom associated with a vehicle traverse across the polar plateau, played a large part in the lack of interest in some of the lunch foods. The contrast between the chocolate bar intake of this traverse and that of man-hauling and dog teams is tremendous. Therefore, each cold weather ration must be tailored to suit the type of country, as well as the means of transport.

The evening meal varied a great deal, as can be seen from the variety of frozen and canned meats in the ration scale. One problem was to obtain liquid refreshment during the travelling days. This was usually accomplished by canned beer or soft drinks which could be thawed on the engine. Thermos bottles would have been very useful for hot drinks during the day. These were not taken on the traverse, since an earlier experience (during a September journey) had showed a tendency for the stoppers to freeze in place, making it difficult to get at the contents. However, the personnel heaters were used sparingly to thaw food during the travelling days, and the thermos flasks could have been opened with the heaters. The wide-mouth flasks have cork stoppers, and these have a tendency to absorb liquid and, consequently, to freeze. Plastic stoppers as used on the smaller flasks would reduce this tendency.

Conditions Affecting Food Consumption

The duration of the traverse was 118 days. This was divided as follows:

Scott Base to Skelton Plateau depot	:25 days

After leaving the Skelton Plateau depot it took 84-1/2 days before the traverse reached the mountains at Station 558. This time was made up as follows:

Travel	:48 full days
"	:14 half days
Work stations, repairs, bad weather	:23 full days
" " " " "	:13 half days

In the remaining 8-1/2 days of the traverse, one day was spent in travelling to Station 559.

The altitude of the Skelton Plateau depot is 7500'. During the next 84 days the trail slowing climbed to 8500' and then decreased slowly to 7500'. After another five days at about 7000', the route dropped to the evacuation point on the Rennick Glacier at 5640'. For 910 miles from the Skelton Plateau depot the surface was generally very rough, while for the remaining 260 miles of the traverse it was comparatively good travelling.

Food Value

The ration scale as worked out for the traverse was generally a fairly well balanced one; that is, if the ration was eaten as it was intended. As previously mentioned, the general lack of activity and boredom while travelling across snow-fields out of sight of any mountainous feature was probably the main cause of dissatisfaction with the ration. It also became difficult for the cook, whose interest in the culinary arts was more a means to an end rather than a sole interest in providing food for the traverse personnel, to keep a high standard of meal preparation and a variety in the types of meals. I would suggest that the traverse cooking be either on a roster basis or that a full-time, and at least partly experienced cook be taken on the journey. Personally, I would favor the latter alternative. Although there were several cases of persistent stomach disorders, this was not general, and was probably the effects of certain foods on individuals, rather than on the group as a whole. Multi-vitamin tablets were taken regularly by the men. It appeared that the traverse personnel finished the 1520 miles 118 days journey in good health, although no systematic record was kept of weights.

In order to serve the peculiar wants of oversnow traverse personnel, and particularly if the party is to be out of sight of land features for a long period, I would suggest a greater amount of canned fruit, jam, small cheeses, and sweetened and unsweetened biscuits. Although the total calorific value of the ration must be fairly high to provide energy to compensate for the low temperatures, allowance should be made for the lack of general physical activity. The high fat diet usually suitable for man-hauling or dog team parties would be unsuitable in this case, and the fat could safely be replaced by a greater amount of carbohydrate.

Food Preparation

The meals were prepared in the "kitchen" Snocat, also known as Messcat. The interior of the vehicle was fitted out with a large heavy table (with collapsible legs so it could be stored on its side), seats (under which were stored the rations), and a sheet metal cooking alcove. A two-burner, white gas stove was used, together with aluminum pots and pressure cookers. The latter were actually too small for the number of men on the traverse and were also of the heavy base type; the thinner sectioned cooker will heat through much more quickly. On the earlier part of the traverse a "McMurdo made" snow melter was used and proved fairly successful. It was later left at one of the depots. Paper plates were used and proved a great success, both from the housekeeping point of view and also becuase the food on them did not cool off as quickly as on china or metal plates. Paper cups were also used on the latter part of the traverse, and they, too, proved a great success. The cook prepared the meals, while the other traverse members cleaned the utensils, etc., at the finish of the meals. A large supply of paper towels were invaluable in this respect.

Greater efficiency would be obtained by having a separate mess wanigan as has been done by some of the other traverses, rather than having a Snocat also used as sleeping quarters for three men. To cook food quickly for eight men it is advisable to have two two-burner stoves and sufficiently large number of cooking pots and pressure cookers, so that snow can be melted at the same time as the food is being cooked.

Typical Daily Menus

Breakfast	fruit juice (made from dehydrated grapefruit and orange crystals) "Farina" (milled wheat cereal) pre-cooked rolled oats dried fruit, milk, sugar bread, butter, jam, honey, peanut butter hot chocolate drink
Midday (travelling)	sardines/meat loaf nut rolls, chocolate bread, butter, jam, etc.
Midday (work day)	canned meats, soup bread, butter, jam, etc. hot chocolate, tea, coffee
Evening meal	frozen meat/canned meat potatoes (dehy.)/rice canned vegetables/dehy. vegetables canned fruit bread, butter, jam, etc. hot chocolate, tea, coffee

Contents Of A 150 Man-Day Unit

Item	Net weight per unit	No. of units
chili con carne	15 oz.	7
meat balls and spaghetti	16	6
beefaroni	16	6
franks and beans	16	5
beef, peas with gravy	12	8
pork sausages	24	2
party loaf	12	4
corned beef	12	7
chicken stew	16	4
bacon	16	3
ham	32	2
pork loin roll	36	4
shrimp	4-1/4	8
chocolate nut roll	8	24
orange nut roll	9	8
pecan nut roll	9	8
fruit cake	32	2
chocolate 400 2 oz. bars		
mixed nuts	7	10
potato sticks	4-1/4	10
rice (instant)	14	4
potato - sweet (dehy.)	48	1
potato - white (dehy.)	96	1
cabbage (dehy.)	16	1
peas - canned	17	10
carrots - canned	16	6
wax beans - canned	16	5
corn - canned	17	5
tomatoes - canned	16	20
Canned fruit		
strawberries	104	3
plums	24	4
apricots	24	4
fruit cocktail	24	4
peaches	24	4
fruit mix (dehy.)	48	1
dried apricots	16	3
dried prunes	16	1/2
dried mixed fruit	16	1-1/2

Item		Net weight per unit	No. of units
sugar		32 oz.	11
dried milk - skim		9-1/2	16
dried milk - chocolate		10	12
cocoa (hot chocolate)		64	3
chocolate drink (Milo)		40	1/2
soup	75 pkts.		
cheese (dehy.)		4	6
jam - cherry		15	3
jam - raspberry		15	3
jam - strawberry		15	3
peanut butter		32	1
honey		6	1
butter		16	31
bread		32	25

Frozen meat - units 50 lbs. each (net). Total quantity for entire traverse:

diced beef	2
beef - roasting	2
beef patties	5
beef steaks	5
diced beef	1
beef steaks (ex Scott Base)	1

Extra items taken on traverse

cheese	25 lbs.
bologna, salami	20 lbs.
sardines	100 cans
catsup, mustard, salt, pepper, "Pream"	

multi-vitamin tablets